Y 29.5

X 28.65

T.M. ® U.S. PAT. OFF.

SYMBOL OF THE FINEST PLASTIC FILM CAPACITORS

WP 9/89
Printed In U.S.A.

CONVERSION FACTORS AND FORMULAE

Plastic Capacitors INC

MANUFACTURERS

- **CAPACITORS**
- **HV POWER PACKS**
- **PULSE FORMING NETWORKS**
- **HI-VOLTAGE TRANSFORMERS**

CONVERSION FACTORS

Presented below are some of the more commonly used conversion factors which we at PLASTIC CAPACITORS, INC. have found useful — we hope you do, too.

MULTIPLY	BY	TO GET
Acres	.0015625	Sq. Miles
Acres	43,560	Sq. Feet
Acres	.40469	Hectares
Amperes/Sq. Cm.	6.452	Amperes/Sq. Inch
Amperes/Sq. Inch	.1550	Amperes/Sq. Cm.
Angstrom	$1x10^{-8}$	Centimeters
Atmospheres	76	Cm. of Mercury
Atmospheres	29.92	Inches of Mercury
Atmospheres	33.90	Feet of Water
Atmospheres	14.70	Lbs./Sq. Inches
BTU	778.3	Foot-Pounds
BTU	1055	Joules
BTU	0.2520	Kilogram-Calories
BTU	.2930	Watts
BTU/Min	17.58	Watts
Cable Lengths	720	Feet
Centimeters	0.2381	Feet
Centimeters	0.3937	Inches
Circular Mils	$7.85x10^{-7}$	Sq. Inches
Cubic CMS	.061	Cubic Inches
Cubic CMS	16.2306	Minims (U.S. FL.)
Cubic CMS	3.697	Drams (U.S. FL.)
Cubic CMS/SEC	.002119	Cubic FT/Minute
Cubic Feet	$2.83x10^{4}$	Cubic CMS.
Cubic Feet	1728	Cubic Inches
Cubic Feet	7.481	Gallons (U.S.)
Cubic Feet	6.229	Gallons (Br.)
Cubic Feet	28.316	Liters
Cubic Feet Air	.08	Pounds
Cubic Feet Water	62.43	Pounds
Cubic Inches	16.38716	Cubic CMS
Cubic Inches	1.8047	Ounce (U.S., FL.)
Cubic Inches	$1.6387x10^{-5}$	Cubic Meters
Dalton	$1.650x10^{-24}$	Grams
Days	1440	Minutes
Days	86,400	Seconds
Drams (avdp.)	1.7718	Grams
Dynes	$1.020x10^{-3}$	Grams
Dynes	$2.248x10^{-6}$	Pounds
Ergs	$9.4805x10^{-11}$	BTU
Feet	30.48	Centimeters
Feet	.3048	Meters
Feet of Water	.02950	Atmospheres
Feet of Water	.8826	Inches of Mercury
Feet of Water	62.43	Pounds/Sq. Foot
Foot-Pounds	$1.285x10^{-3}$	BTU
Foot-Pounds	1.356	Joules
Foot-Pounds	$3.238x10^{-4}$	Kilogram-Calories

Plastic Capacitors, Inc.
2623 N. PULASKI ROAD
CHICAGO, ILLINOIS 60639
Area 312, Phone 489-2229
FAX: 312-489-0496

A WORD ABOUT PCI

Plastic Capacitors, Inc. was incorporated in Illinois in 1952 and is a closely held corporation.

We specialize in custom designed High Voltage components. We catalog capacitors of 200,000 volts, have designed banks of capacitors up to 3,000,000 volts.

Our Quality Control System meets the requirements of MIL-I-45208A and MIL-STD-45662.

Our factory is located in Chicago, the transporation center of the United States, and is over 56,000 square feet in area. All of our products are manufactured with pride in Illinois.

Call or write us with your problem applications and if it is an item that we cannot manufacture, we can probably tell you where to obtain it.

LIMITED WARRANTY

Plastic Capacitors, Inc. warrants its products under normal usage and service, against defects in workmanship or materials, for a period of ONE (1) YEAR from the date of delivery.

The sole obligation of PLASTIC CAPACITORS under this warranty shall be to repair or replace any part which, in the opinion of P.C.I., shall prove to be defective in normal use and service within said ONE (1) YEAR period from the date of delivery. This warranty does not cover normal wear and tear. In addition, the warranty shall be null and void if the equipment is modified, improperly installed or used, or damaged by accident or neglect, or ortherwise repaired by another party during the aforesaid period. PLASTIC CAPACITORS reserves the right, in its sole discretion, to replace any product or part thereof, found to be defective.

Defective products shall be returned, freight prepaid, directly to PLASTIC CAPACITORS, 2623 N. Pulaski Rd., Chicago, IL 60639.

THE ABOVE WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. PLASTIC CAPACITORS shall not be liable for any damages sustained by its customer or any other party arising from or relating to any product failure, including, but not limited to, consequential damages, nor shall PLASTIC CAPACITORS have any liability for delays in replacement or repair of its products.

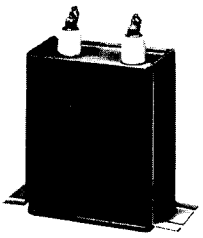
No agent, representative, dealer or employee of PLASTIC CAPACITORS shall have the authority to increase, alter or otherwise modify the provisions of this LIMITED WARRANTY.

Plastic Capacitors, Inc.
2623 N. PULASKI ROAD
CHICAGO, ILLINOIS 60639
Area 312, Phone 489-2229
FAX: 312-489-0496

CONVERSION FACTORS

MULTIPLY	BY	TO GET
Foot-Pounds	3.766×10^{-7}	Kilowatt Hours
Foot-Pounds/Min.	2.260×10^{-5}	Kilowatts
Furlong	660	Feet
Gallons	3785	Cubic Centimeters
Gallons	.1337	Cubic Feet
Gallons	231	Cubic Inches
Gallons	3.7853	Liters
Gallons/Second	8.0192	Ft. 3/Minute
Gausses	6.452	Lines/Sq. Inch
Gill (Br.)	5	Ounces (Br. Fl.)
Gill (Br.)	.1421	Liters
Gilberts	.7958	Ampere Turns
Gilberts/Cm.	2.021	Ampere Turns/Inch
Grams	980.7	Dynes
Grams	.03527	Ounces
Grams	.07093	Poundals
Grams	2.205×10^{-3}	Pounds
Gram Calories (It.)	3.968×10^{-3}	BTU
Grams/Centimeters	5.60×10^{-3}	Pounds/Inch
Grams/Cu.Cm.	62.43	Lbs./Cu.Foot
Grams/Cu. Cm.	.03613	Lbs./Cu. Inch
Hectares	2.471	Acres
Hectares	1.0764×10^{5}	Sq. Feet
Horse-Power (Metra)	.98632	Horsepower (U.S.)
Horse-Power (U.S.)	42.40	BTU/Min.
Horse-Power (U.S.)	33,000	Foot-Pounds/Min.
Horse-Power (U.S.)	550	Foot-Pounds/Sec.
Horse-Power (U.S.)	10.68	KG-Calories/Min.
Horse-Power (U.S.)	.7457	Kilowatts
Horse-Power (U.S.)	745	Watts
Horse-Power Hours	2545	BTU
Horse-Power Hours	1.98×10^{6}	Foot-Pounds
Horse-Power Hours	2.684×10^{6}	Joules
Inches	2.54	Centimeters
Inches	2.54×10^{8}	Angstroms
Inches of Mercury	.03342	Atmosphere
Inches of Mercury	1.133	Feet of Water
Inches of Mercury	.4912	Pounds/Sq. Inch
Inches of Water	.002458	Atmospheres
Inches of Water	.07355	Inches of Mercury
Inches of Water	25.4	MM. of Mercury
Inches of Water	5.204	Pounds/Sq. Foot
Inches of Water	.03613	Pounds/Sq/ Inch
Joules (Int)	9.480×10^{-4}	BTU
Joules (Int)	.7378	Foot-Pounds
Joules (Int)	2.778×10^{-4}	Watt-Hours
Kg/CM^2	14.2234	$Pounds/Inch^2$
Kg/M^2	.204817	$Pounds/Ft^2$
Kg/M^3	.062434	$Pounds/Ft^3$
Kilograms	2.205	Pounds

TYPE LK
Medium And High Voltage
Hermetically-Sealed Capacitors



TYPE LK CAPACITORS offer unusually good electrical characteristics, coupled with very small size. They are designed to meet the requirements of MIL-C-25 AND MIL-C-19978, but are not a QPL item.

TYPE LK CAPACITORS are specifically designed for filter, bypass and coupling applications in the low audio frequency range. The CP70 style container and internal construction permit operation in any position. Glazed steatite or alumina bushings are used as terminals. The terminal stud is supplied with a nut, washer and/or solder lug. The whole assembly is hermetically sealed. Footed mounting brackets are supplied with all LK units.

TYPE LK capacitors are cataloged in our 200 voltage and capacitance combinations, many with alternative packaging sizes. Catalog Voltage ratings available range from 600 VDC to 50 KVDC, with capacitance values of .1mfd-50mfd at the lower end to .005mfd-.5mfd at the higher voltages. Other voltage/capacitance values available upon request.

Mylar* film and Kraft capacitor tissue are used as the dielectrics; environmentally safe mineral oil is used as the impregnant. For full details, ask for catalog sheet A9.

The following chart is representative of catalog designs; the sizes given are Length x Width x Height of the capacitor, not including the height of the terminal.

PART NUMBER	DC VOLTS	CAP. MFD.	SIZE (Inches)
LK6-106	600 V	10	3 3/4 x 1 1/4 x 4 1/2
LK50-104	5 KV	.1	1 3/4 x 1 x 2 1/8
LK50-406Y	5 KV	40	7 3/8 x 5 5/8 x 11
LK200-205	20 KV	2	13 1/2 x 4 1/8 x 9 1/4
LK500-104Z	50 KV	.1	6 x 4 11/16 x 6 1/2

***DuPont Polyester Film**

CONVERSION FACTORS

MULTIPLY	BY	TO GET
Kilogram-Calories	3.968	BTU
Kilogram-Calories	3088	Foot-Pounds
Kilogram-Calories	4186	Joules
Kilogram-Calories	1.163×10^{-3}	Kilowatt-Hours
Kilometers	3281	Feet
Kilometers	.6214	Miles
Kilometers/Hr.	27.78	Cms./Sec
Kilometers/Hr.	54.68	Feet/Min.
Kilometers/Hr.	.9113	Feet/Sec.
Kilometers/Hr.	.6214	Miles/Hour
Kilowatts	56.88	BTU/Min.
Kilowatts	4.427×10^{-4}	Foot-Pounds/Min.
Kilowatts	1.341	Horse-Power
Kilowatts	14.33	KG-Calories/Min.
Kilowatt Hours	3413	BTU
Kilowatt Hours	2.656×10^{6}	Foot-Pounds
Kilowatt Hours	1.341	Horse-Power-Hours
Kilowatt Hours	3.6×10^{6}	Joules
Kilowatt Hours	860	Kilogram-Calories
Knots	6080	Feet/Hr.
Knots	1.152	Miles/Hr.
League (Naut.)	.333	Miles (Naut.)
Lines/Sq. Cm.	1	Gausses
Lines/Sq. In.	.1550	Gausses
Liters	.03531	Cubic Feet
Liters	61.02	Cubic Inches
Liters	.2642	Gallons
Liters	33.8147	Ounces (U.S. Fl.)
Liters/second	15.85	Gallons (U.S.)/Minute
Lux	.0929	Foot Candles
Meters	3.281	Feet
Meters	39.37	Inches
Meters	6.214×10^{-4}	Miles
Microns	0.001	Millimeters
Miles	1.609×10^{5}	Centimeters
Miles	5280	Feet
Miles	1.609	Kilometers
Miles/Hour	1.4667	Feet/Sec.
Miles/Hour	44.70	Cm./Sec.
Miles/Hour	88	Feet/Min.
Miles/Hour	.8684	Knots
Millimeters of Mercury	1.3595	Grams/Cm^2
Minutes	6.944×10^{-4}	Days
Minutes	.01667	Hours
Minutes (Angle)	2.909×10^{-4}	Radians
Ounces	437.5	Grains
Ounces	28.35	Grams
Ounces	.0625	Pounds
Ounces (Fluid)	1.805	Cubic Inches
Ounces (Fluid)	29.57	Cu. Centimeters

TYPE OF
Medium And High Voltage
Hermetically-Sealed Capacitors

TYPE OF of capacitors offer small values of capacitance (from .0001 to 0.5 mfd) in the medium and high voltage range—2000 volts to 60,000 volts. The capacitor element utilizes a paper plastic dielectric and is impregnated with highly purified and inhibited mineral oil.

The capacitor element is encased in a heavy-wall hard glass tube. Sealing is accomplished by soldering tinned monel ferrules to each end of the glass tube. Tinned wire leads or axial studs enable easy electrical connection and mounting.

Capacitance change is less than 6% from minus 60°C to 105°C and power factor is well under 1% at 60 and 1000 cycles except at very low temperatures. The capacitors may be mounted in any position. Peak to peak ripple voltage may be 25% at 60 cycles, 20% at 120 cycles, 5% at 400 cycles of the nameplate voltage rating, provided the peak voltage does not exceed the nameplate voltage rating. Dielectric resistance, measured with nameplate voltage rating and with two minutes electrification time is 10,000 megohms x mfd at 20°C and 1200 megohms x mfd at 85°C.

Operating temperature range is minus 55°C to 85° with nameplate rated voltage, and may be used at 105°C with 60% nameplate rated voltage. Non-operating temperature range is minus 65°C to 110°C.

APPLICATIONS. The excellent electrical characteristics make type OF capacitors extremely useful in the low current power supplies and coupling and bypass applications in the low and medium and high frequency audio range.

TYPE OF capacitors are designed to pass the tests and exceed the requirements of MIL-C-25D for terminal "D".

NOT QPL LISTED

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MULTIPLY	BY	TO GET
Pounds/Cu. Inch	27.68	Grams/Cu. Centimeters
Pounds	444,823	Dynes
Pounds (Avdp.)	453.6	Grams
Pounds of Air	12.5	Cubic Feet
Pounds of Water	.01602	Cubic Feet
Pounds of Water	27.62	Cubic Inches
Pounds of Water	.1198	Gallons
Pounds/Cubic Foot	.01602	Grams/Cubic Cm.
Pounds/Cubic Foot	5.787×10^{-4}	Pounds/Cubic Inch
Pounds/Sq. Foot	4.725×10^{-4}	Atmospheres
Pounds/Sq. Foot	4.882	Kgs./Square Meter
Pounds/Sq. Foot	$.6944 \times 10^{-3}$	Pounds/Square Inch
Pounds/Sq. Inch	2.307	Feet of Water
Pounds/Sq. Inch	.06804	Atmospheres
Pounds/Sq. Inch	5.1715	Cms. of Mercury
Pounds/Sq. Inch	2.036	Inches of Mercury
Quart (U.S. dry)	1.10119	Liters
Quart (U.S. Fl.)	.946326	Liters
Radians	57.30	Degrees
Rods	5.0292	Meters
Square Centimeters	1.973×10^{5}	Circular Mils
Square Centimeters	1.076×10^{-3}	Square Feet
Square Centimeters	0.1550	Square Inches
Square Feet	2.296×10^{-5}	Acres
Square Feet	929	Sq. Centimeters
Square Inches	1.273×10^{6}	Circular Mils
Square Inches	6.452	Sq. Centimeters
Square Meter	10.76391	Sq. Feet
Square Miles	6.40	Acres
Square Miles	2.788×10^{7}	Sq. Feet
Square Yard	1296	Sq. Inches
Square Yard	.836127	Sq. Meter
Ton (Short)	907.185	Kilograms
Ton (Short)	2000	Pounds
Ton (Long)	2240	Pounds
Watts	.05688	BTU/Min.
Watts	44.254	Foot-Pounds/Min.
Watts	1.341×10^{-3}	Horsepower
Watts	.01433	KG-Calories/Min.
Watt Hours	3.413	BTU
Watt Hours	2656	Foot-Pounds
Watt Hours	.860	Kilogram-Calories
Webers	10	Maxwells
Yards	.914402	Meters
Years (365 days)	8760	Hours

We hope that you have found our booklet useful and, of course, that you will keep us in mind when you need the high voltage products that we manufacture. If you have any comments on this booklet or have some special equations that might be of use to other engineers, please let us know!

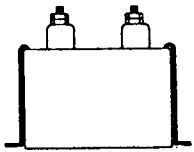
Capacitors which operate at 400Hz to the megahertz frequencies normally handle kilovolt-amperes. This type of operation requires the capability of not overheating with the KVA and must be constructed to handle large current values. Therefore, the dissipation factor is necessarily low.

Typical applications would include:

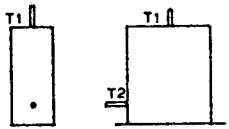
- RF and audio frequency tuning circuits
- Low series inductance discharge circuits
- RF coupling and bypass
- Power factor correction
- SCR commutation
- Pulse forming networks
- De-spiking networks
- Induction heaters

This type of capacitor, generally using polyproplyene film as the solid dielectric, is available in many different case styles, to provide alternative packaging configurations for almost any application.

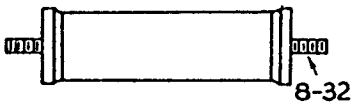
Among the most popular container styles available are:



CP70 type steel or brass can, with steatite HV bushings.



Phenolic case rectangular, footed mounting plate, brass screw terminations.



Glass case tubular, with Monel metal end caps, brass screw terminations.

CALL US WITH YOUR SPECIFIC DESIGN PROBLEMS AND APPLICATIONS.

CAPACITOR LIFE

Generally, capacitors follow certain laws of life making possible a fairly good determination of life expectancy under operating conditions. Operating conditions for hermetically-sealed DC filter types primarily involve temperature and voltage. Short term life testing at the extremes of voltage and temperature will permit interpolation by means of formulae. Extrapolation may lead to erroneous conclusions.

For this reason, 250 to 1000 hours life tests at high temperature and at a voltage above the desired operating voltage can lead to conclusions regarding operating life.

For determining life at the operating voltage

$$\frac{V_T^5}{V_O^5} = \frac{L_O}{L_T} \quad \text{OR} \quad L_O = \frac{V_T^5 L_T}{V_O^5}$$

Where V_T is the short time test voltage.
V_O is the operating voltage.
L_T are the hours of mean life at the test voltage.
L_O are the hours of life expectancy at the operating voltage and the test temperature.

For determination of life at other temperatures, the general law of chemical activity is used. Preferably the operating temperature should be the same or lower than the test temperature.

$$\frac{T_T^7}{T_O^7} = \frac{L_O}{L_T} \quad \text{OR} \quad L_O = \frac{T_T^7 L_T}{T_O^7}$$

Where T_T is the test temperature in degrees Kelvin.
T_O is the operating temperature in degrees Kelvin.

Relationship among temperature scales

Degrees Kelvin = Degrees Centigrade +273

Degrees Fahrenheit = 9/5 °C. +32

Degrees C. = (°F −32) × 5/9

TEMPERATURE SCALES

K°	C°	F°
0	−273	−459
73	−200	−328
173	−100	−148
213	− 60	− 76
233	− 40	− 40
255.2	− 17.8	0
273	0	32
293	20	68
338	65	149
358	85	185
373	100	212
398	125	257
423	150	302
473	200	392

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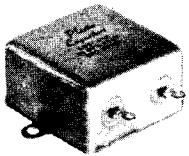
TYPE AB

Metallized Mylar ★ Capacitors
Hermetically-Sealed



MYLAR* FILM, one of the many dielectrics employed by Plastic Capacitors, Inc. in the fabrication of the highest quality capacitors, offers particular advantages not obtainable with other materials. Mylar* satisfies the requirements of high resistance, low absorption, excellent retrace and capacitance stability over a wide temperature range and high ambient operating conditions.

METALLIZED MYLAR* has several advantages that are outstanding. The self-healing characteristics are well-known and extend the useful life of the capacitor. The second, and most over-looked feature, is the possibility of making full use of the highest volts-per-mil rating of the film by eliminating all the weak dielectric areas. This results in extreme small size without sacrificing life, reliability and economy.

Unlike other metallized dielectrics, metallized Mylar* does not spark, and may be used in very low voltages since there is no problem of particle migration. Plastic Capacitors TYPE AB in bathtub containers achieve the maximum possible characteristics of Mylar* film.

Other container shapes and materials are also available: phenolic round and rectangular; rectangular CP70 type cases in steel or brass.

TYPE AB capacitors are available rated at 200, 300, 400 and 600 VDC in 37 voltage/capacitance combinations ranging from .05 mfd to 30 mfd. Standard capacitance tolerance is ±20%.

TERMINALS are glass to metal solder seals and may be mounted on the front of the unit (as shown) or on the top or bottom.

EXTENDED FOIL construction provides low inductance and internal wiring is designed with discharge applications in mind. Call for discharge ratings on specific values.

For more information, ask for catalog data sheet B11.

★ DUPONT POLYESTER FILM

CAPACITOR EQUATIONS

PARALLEL

$$C_T = C_1 + C_2 + C_3 + \ldots$$

SERIES

$$C_T = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots}$$

C_T – Total Capacitance

C – Capacitance in Farads

$q = CE$

q – Coulombs Charge Equal to One Ampere For One Sec.

$$X_c = \frac{1}{2\pi fC}$$

X_c – Capacitance Reactance

$$D_f = \frac{R_s}{X_c}$$

D_f – Dissipation Factor

$$Z_c = \sqrt{X_c^2 + R_s^2}$$

R_s – Equivalent Series Resistance

$$P_f = \frac{R_s}{Z_c}$$

Z_c – Impedance of C

P_f – Power Factor

JOULES = $\frac{1}{2}CE^2$

One Joule = One Watt Second

Current Flowing in a Circuit of R Ohms and C Farads Series Capacitance t Seconds After the Source of EMF is Short Circuited, the Potential Across the Capacitor at the Instant of Short Circuiting Being E Volts

$$i = \frac{E}{R}\epsilon^{-t/RC}$$

i – Instantaneous Current

E_T – Unidirectional Voltage

R – DC Resistance in Ohms

t – Time in Seconds

ϵ – Epsilon 2.718

$$q = CE\epsilon^{-t/RC}$$

$$E_T = E\epsilon^{-t/RC}$$

$VAR = I^2X_c$

$VA = I^2Z$

POWER LOSS OF CAPACITOR

$P = VA \cos\theta$

VAR – Volt-Amperes Reactive

I – RMS or DC Current

$$P = VA\,\frac{R_s}{Z}$$

VA – Volt-Amperes

P – Power in Watts

P = VA • Power Factor

f_r – Resonant Frequency

$\pi = 3.1416$

$2\pi = 6.2832$

$VA = \sqrt{P^2 + (VAR)^2}$

OHMS LAW $R = \frac{E}{I}$

L – Inductance in Henrys

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

X_L – Inductance Reactance

$X_L = 2\pi fL$

f – Frequency

$$Z_L = \sqrt{X_L^2 + R_L^2}$$

Q – Figure of Merit for Capacitors or Inductors

$$Q = \frac{X_L}{R_s} \text{ or } \frac{X_C}{R_s}$$

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POWER PACKS

PLASTIC CAPACITORS INC. manufacture a wide range of low-current, high voltage power supplies as cataloged items available from stock.

TYPE HV-M silicon diode power packs use the latest technique and advanced materials to achieve small package size.

Available with output ratings of 1,000 volts to 100 KVDC at 1.5, 5.0 or 10 ma, these hermetically sealed, oil filled power packs may have the output voltage adjusted by means of varying the input voltage from 0 to 118 VAC at 50 to 500 Hz. Also available is 0 to 230 VAC input.

HV50-502M

Long life and low ripple are among the many features in this latest development in the state of the art for production of power supplies consistent with economy.

Write for complete specifications.

HV500-502M

PART NUMBER	OUTPUT KVDC	OUTPUT MA	CONTAINER SIZE
HV50-502M	5	5.0	2¼ x 3¾ x 3¾
HV100-103M	10	10	3¾ x 4⁹⁄₁₆ x 8
HV200-152M	20	1.5	3¾ x 4⁹⁄₁₆ x 5⅛
HV250-103M	25	10	5⅜ x 7¹¹⁄₃₂ x 12¾₁₆
HV300-152M	30	1.5	3¾ x 4⁹⁄₁₆ x 7½
HV500-502M	50	5.0	5⅜ x 7¹¹⁄₃₂ x 12¾₁₆
HV750-152M	75	1.5	5⅜ x 7¹¹⁄₃₂ x 12¾₁₆

This is a partial listing.

DESIGN LIFE is 40,000 hours at 35° C and 25,000 hours at 65° C. Most units may be mounted in any position and will withstand a substantial vibration test. All will withstand a 50 hour salt spray test and are painted with zinc chromate primer and blue-grey lacquer per MIL-L-7178.

POLARITY. All but the 75KV & 100KV output units are made with both positive and negative output terminations, with the output independent from the case. The 75KV & 100KV units are available with either positive or negative outputs, as specified on your order to the Factory.

CORONA SPHERES are sent with power packs having an output of 25KV and above; the corona sphere forms the termination, with a user-supplied miniature banana plug.

POWER SUPPLY FILTER EQUATIONS

FULL WAVE RECTIFICATION

Critical Value of Inductor For Inductor Input to Filter

$R + R_L = 1131L$ 60 CPS Input

$R + R_L = 7536L$ 400 CPS Input

$$I_{DC} = \frac{2\sqrt{2}}{\pi} \cdot \frac{E_S}{R + R_L}$$

$$E_{DC} = \frac{2\sqrt{2}}{\pi} \cdot \frac{R}{R + R_L} \cdot E_S$$

$$E_2 = \frac{4}{3\pi} \cdot \frac{E_S}{(4\omega^2 L_1 C_1)(4\omega^2 L_2 C_2)}$$

Ripple Factor for LC Networks For Each Section Ripple Is Reduced By This Factor

$$R.F. = \frac{0.827 \times 10^{-6}}{LC} \quad (60 \text{ CPS})$$

$$R.F. = \frac{187 \times 10^{-10}}{LC} \quad (400 \text{ CPS})$$

$$R.F. = \frac{1}{4\omega^2 LC} \quad (\text{ANY FREQ.})$$

R —Load
R_L —Resistance of Inductor
L —Inductance in Henrys
I_{DC} —Direct Current Output
E_S —Peak Varying Potential on the Cathode of the Rectifier Somewhat Less than the Peak AC
E_{DC} —Voltage Output
E_2 —Ripple Voltage For Two Section Filter
L_1L_2—Inductance In Each Section
C_1C_2—Capacitance In Each Mesh
ω —$2\pi f$
R.F.—Ripple Factor
C —Capacitance In Farads

TRANSFORMER RELATIONSHIPS

$$\frac{N_P}{N_S} = \frac{E_P}{E_S} = \frac{I_S}{I_P} = \sqrt{\frac{Z_P}{Z_S}}$$

$$N = \frac{3.49E \times 10^6}{fA_cB}$$

$$L = \frac{3.19\,N^2 A_c \cdot 10^{-8}}{lq + \frac{lc}{\triangle\mu}}$$

$$D.C.\ FLUX = \frac{0.6\,NI_{DC}}{lq}$$

Z —Impedance
N —Number of Turns
P —Primary
S —Secondary
I —AC Current RMS
E —AC Volts
f —Frequency
A_c—Area of Iron Core Sq. In.
B —In Gauss
lq —Core Gap Inches
lc —Core Length in Inches
RMS—Root Mean Square
$\triangle\mu$ = Incremental Permeability

SINUSOIDAL RELATIONSHIPS

RMS = 0.707 x Peak Value
Average Value = 0.637 Peak
Peak to Peak Value = 2.828 RMS
Peak Value = 1.41 RMS

HIGH VOLTAGE TRANSFORMERS

As a specialty line, PCI can supply transformers for operation with inputs of 50, 60 and 400Hz. We have been manufacturing transformers for use in our HV-M power packs for many years, and now offer transformers to your design specification, with output voltages ranging from 5KV to 100KV.

METERED POWER SUPPLIES

CASED or rack-panel mounted power supplies are available with voltage output to 50KVDC and have the following features:

- INPUT 50 or 60HZ with variable transformer to control output voltage
- OUTPUT single or double polarity, with plug-in, shielded high voltage cable
- METERS—Kilovolt output and Current
- GROUNDED 3 pin plug and line cord, to pass OSHA requirements
- ON-OFF SWITCH and pilot light
- OVERLOAD protection against accidental shorting
- FUSED

CONSIDERATIONS OF CAPACITOR APPLICATIONS

Filter capacitors are not designed for repetative discharges.

The volt-amperes to which the capacitor is subjected will cause heating. In filter applications, the ripple percentage is critical. The filter capacitor will change energy levels from the peak of the ripple to the low point of the ripple and at a rate of 2 times the ripple frequency.

Ionization in a capacitor is destructive. Since there is always some current flow thru the capacitor, under pure DC conditions, the life of the capacitor may be affected if hot spots develop due to excessive current. However, alternating currents can cause hot spots to develop to such an extent that the impregnant vaporizes, resulting in vapor ionization and excessive heating.

There is no hard and fast rule or ratio for DC voltage to AC voltage rating for capacitors rated more than 1000VDC.

Increasing the operating ambient of the capacitor decreases the life expectancy.

Plastic Capacitors, Inc.
2623 N. PULASKI ROAD
CHICAGO, ILLINOIS 60639
Area 312, Phone 489-2229
FAX: 312-489-0496

RESISTIVITY

Resistivity in Microhms per Centimeter Cube at 20°C	
MATERIAL	MICROHMS
ALUMINUM	2.828
ANTIMONY	41.7
BERYLLIUM	10.1
BISMUTH	120
CARBON	3450
CALCIUM	4.6
CHROMIUM	2.8
CONSTANTAN	44.2
COBALT	9.7
COPPER	1.7
GOLD	2.44
IRON	10.0
LEAD	22.0
MAGNESIUM	4.6
MANGANESE	5
MANGANIN	44
MERCURY	95.8
MOLYBDENUM	5.7
NICHROME*	100
NICKEL	6.84
PALADIUM	11
PLATINUM	10
RHODIUM	4.6
SILVER	1.59
TANTALUM	15.5
TIN	11.5
TITANIUM	48-60
TUNGSTEN	5.6
ZINC	5.8

SPECIFIC HEAT

Specific Heat of some common materials BTU per pound per degree F. or Gram-Calories per pound per degree C. Average from O° to 100°C. (at one atmosphere)	
MATERIAL	HEAT
AIR	.238
ALUMINUM	.226
ASBESTOS	.195
BERYLLIUM	.425
BRASS	.092
CARBON DIOXIDE	.202
COPPER	.0928
CORK	.485
GLASS	.180
ICE (AT -2°C)	.502
IRON	.117
LEAD	.0309
MERCURY	.033
MICA	.206
MINERAL OIL	.505
PLANTINUM	.032
PORCELAIN	.260
QUARTZ	.188
SILICON	.181
SILVER	.056
TIN	.0556
TUNGSTEN	.034
WATER	1.000
WOOD	.420
ZINC	.095

*T.M.

COLOR SCALE OF TEMPERATURE

Commonly used terms to describe color of heat related to an approximation of temperature in degrees centigrade.

COLOR	TEMPERATURE DEGREES CENTIGRADE
INCIPIENT RED HEAT	500- 550
DARK RED HEAT	650- 750
BRIGHT RED HEAT	800- 900
ORANGE-RED HEAT	900-1000
YELLOW HEAT	1050-1150
INCIPIENT WHITE HEAT	1250-1350
WHITE HEAT	Above 1450

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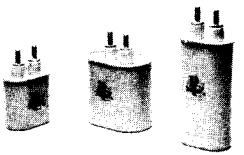


TYPE BVX Capacitors are designed for smoothing the spikes generated by SCR's. All are designed for low inductance and use low-loss film dielectrics. Of particular note for reliability is that all oil-seal locations are soldered, not gasketed, assuring trouble-free operation.

Catalog voltage ratings are 350, 600 and 1000 volts peak. Capacitors are designed to be operated while mounted in any position. Bushings are glazed steatite with threaded brass contacts for maximum current carrying capability. Containers are deep drawn steel.

The following chart is representative of catalog designs; the sizes given are Length x Width x Height of the capacitor, not including the height of the terminal. For full information, ask for catalog sheet E3.

PART NUMBER	PEAK VOLTS	CAP. MFD.	MAX. VA	SIZE (inches)
BVX35-105	350	1	3610	2.16 x 1.31 x 2.88
BVX35-106	350	10	7690	2.91 x 1.91 x 4.75
BVX60-205	600	2	5470	2.91 x 1.91 x 3.88
BVX60-106	600	10	13600	3.66 x 1.97 x 6.25
BVX100-305	1000	3	7360	2.91 x 1.91 x 4.50
BVX100-505	1000	5	9660	2.91 x 1.91 x 6.25

EQUATIONS FOR AC CAPACITORS

$VA = (E^2)(2\pi fC)$

VA x Df = watts Lost (HEAT!)

$I = (E)(2\pi fC)$

$VAR = \frac{E^2}{X_c}$

Phase to neutral $E = \frac{E_{pp}}{\sqrt{3}}$

E_{pp}-Phase-phase voltage (Line Voltage, 3 Phase)

VA-Volt-Amperes
VAR-Volt-Amperes Reactive
E-Voltage in volts
C-Capacitance in Farads
f-Frequency in Hertz
I-Current in amperes
Df-Dissipation (power) Factor
X_c-Capacitance Reactance
2π-6.2832

DEFINITIONS OF COMMON ELECTRONIC TERMS

AVALANCHE DIODE
A silicon diode that has a high ratio of reverse to forward resistance until avalanche breakdown occurs. After breakdown, the voltage drop across the diode is essentially constant and independent of current. Also called breakdown diode; originally called zener diode, before it was found that the zener effect had no significant role in the operation of diodes of this type.

BREAKDOWN VOLTAGE
The voltage required to jump an air gap or to "break down", i.e., penetrate, a solid or liquid dielectric.

CAPACITOR (Symbol C)
A device consisting essentially of two conducting surfaces, separated by an insulating material such as air, paper, mica, ceramic, glass or plastic film. A capacitor can: store and discharge electrical energy; block the flow of direct current; permit the flow of alternating current to a degree dependent on its capacitance and the frequency. Call us with your specific application.
Sometimes still (and incorrectly) called an electrical condenser.

CMOS (Complementary MOS)
With extra diffusions, a circuit with both P- and N-channel FETs on the same MOS wafer. CMOS, complementary metal-oxide-semiconductor logic, is designed to have extremely low power dissipation (essentially zero during standby) making it especially useful for remote applications where power is expensive. Other attributes: high noise immunity, high fan-out, full power supply swings and ready acceptance of a wide range of power supplies.

DC BREAKDOWN
Voltage at which ionization occurs when subjected to a slowly rising DC voltage.

DIELECTRIC
A material in a capacitor that can serve as an insulator because it has poor electrical conductivity. At PCI, we use a wide range of liquid and film dielectrics to assure good capacitor life in virtually any high voltage application. The dielectric separates the two (or more) conducting plates of the capacitor.

DIODE
Basic in semiconductor art; it passes current in one direction and blocks it in the other.

ELECTRONIC
Pertaining to the application of that branch of science which deals with the motion, emission and behavior of currents of free electrons, especially in vacuum, gas or phototubes and special conductors or semiconductors; contrasted with ELECTRIC, which pertains to the flow of large currents in wires or conventional conductors.

DEFINITIONS OF COMMON ELECTRONIC TERMS Continued

ELECTROSTATIC
Pertaining to electricity at rest, such as an electrical charge on an object.

FILM RESISTOR
A component in which the resistance element is a thin layer of conductive material on an insulated form. The conductive material does not contain either binders or insulating material.

IMPULSE BREAKDOWN
Voltage at which ionization occurs when subjected to fast-rising voltage. One of our customers tried to destroy a special capacitor, to determine its safety factor . . . a 900KV impulse test could not destroy it.

IMPULSE RATIO
Ratio of impulse breakdown to DC breakdown.

IONIZATION
The result of adding or subtracting one or more electrons from a neutral atom or group of neutral atoms.

KISS
Abbreviation for a method of reducing the complexity of information fed into a computer. (Keep It Simple, Stupid.)

MOS
Abbreviation for metal-oxide-semiconductor. It is one of the solid state technologies used for the fabrication of large, low cost memories with high input impedance. The insulator used is an oxide of the semiconductor substrate material.

NANOSECOND (NS)
One billionth of a second or one millimicro second. An electric current travels a distance of about one foot in one nanosecond on a wire.

PEAK DISCHARGE ENERGY
Maximum amount of energy that a device can withstand during operation without permanent or significant change in breakdown ratings or specified life expectancy.

PEAK CURRENT
Maximum amplitude of current ionized device can pass without permanent change in breakdown ratings or specified life expectancy.

RINGING
Transient decaying oscillation about high or low limit induced by unmatched impedance reflections.

TRIP VOLTAGE
Voltage at which ionization occurs under any circumstances (also referred to as firing voltage).

ZAPPING
Slang for burning out.

CARATS vs. KARATS
(Not the garden variety)

With widespread interest in the purchase of precious metals and precious stones as an investment opportunity, we include a few conversion factors and definitions relating to trading commodities.

A CARAT is a measure of weight of precious stones equivalent to 200 milligrams. To make small stones sound larger, sizes of fractional carat items are frequently quoted in POINTS. A point represents 2 milligrams, 100 points to the carat.

A KARAT has nothing to do with weight, but is a measurement of the purity of gold. In this context, 24K gold is pure; 18K is 75% gold; 12K is 50% gold. Many other metals are alloyed with pure gold to give it strength and different colors. The most common are Copper and Silver in various proportions, but also used in some formulations are Iron, Zinc, Platinum, Nickel, Palladium, Brass or Aluminum.

Precious metals prices are usually quoted by the Troy ounce or gram, but they are frequently sold in other measures.

One TROY OUNCE EQUALS:

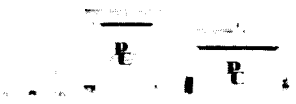
31.1035 grams	1.0971 ounces Avdp.
20 pennyweights	.08333 pounds TROY
480 grains	.06857 pounds Avdp.

There are 12 Troy ounces in a Troy pound.

PREFIXES OF UNITS

Multiples and sub-multiples	Prefixes	Symbols
$1\,000\,000\,000\,000 = 10^{12}$	tera	T
$1\,000\,000\,000 = 10^{9}$	giga	G
$1\,000\,000 = 10^{6}$	mega	M
$1\,000 = 10^{3}$	kilo	k
$100 = 10^{2}$	hecto	h
$10 = 10$	deka	da
$0.1 = 10^{-1}$	deci	d
$0.01 = 10^{-2}$	centi	c
$0.001 = 10^{-3}$	milli	m
$0.000\,001 = 10^{-6}$	micro	μ
$0.000\,000\,001 = 10^{-9}$	nano	n
$0.000\,000\,000\,001 = 10^{-12}$	pico	p
$0.000\,000\,000\,000\,001 = 10^{-15}$	femto	f
$0.000\,000\,000\,000\,000\,001 = 10^{-18}$	atto	a

TYPE LJ
30KVDC to 200KVDC
Phenolic Case Capacitors



TYPE LJ CAPACITORS are designed for high voltage application with plastic-paper dielectric capacitor elements. Connections are made to the extended foil sections with medium-heavy wiring allowing large discharge current. Consult factory for current and repetition rate limits. Applications include; power supply filters, discharge, pulse forming networks, bypass, and arc and spark suppression.

Operating Temperature range is -55°C to +65°C, without derating.

Test voltage is 150% of nameplate voltage for 2 minutes in air, at room temperature.

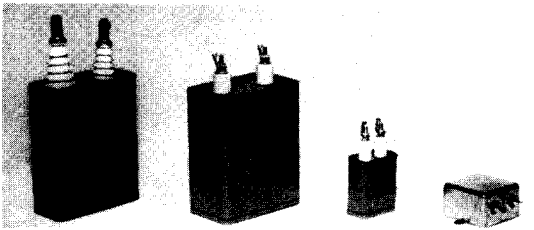
Terminations are brass screws or threaded inserts, thus eliminating the need for large and expensive ceramic bushings.

Over 100 different voltage/capacitance combinations are offered as standard designs. The following table is representative of the sizes and voltages available. Sizes shown are length (A) X width (B) X height (C). For Full Information, Ask For Catalog Sheet A5.

PART NUMBER	CAP. MFD.	KV DCW	A	B	C
LJ300-103BF	.01	30	2 3/4	1 3/4	6
LJ300-503BF	.05	30	3 3/4	2 3/4	6 1/2
LJ300-104BF	.10	30	4 3/4	3 3/4	6
LJ300-254BF	.25	30	6 3/4	4 3/4	6 1/4
LJ300-504BF	.50	30	10 3/4	5 3/4	6
LJ1000-202BF	.002	100	2 3/4	1 3/4	14
LJ1000-103BF	.01	100	4 3/4	1 3/4	14
LJ1000-503BF	.05	100	6 3/4	3 3/4	15
LJ1000-104BF	.10	100	8 3/4	5 3/4	14
LJ1000-254BF	.25	100	10 3/4	7 3/4	18
LJ2000-102BF	.001	200	2 3/4	1 3/4	26
LJ2000-502BF	.005	200	4 3/4	1 3/4	26
LJ2000-103BF	.01	200	4 3/4	2 3/4	27
LJ2000-503BF	.05	200	8 3/4	5 3/4	26
LJ2000-104BF	.10	200	10 3/4	7 3/4	27

YOUR NOTES

Other Capacitor Products
Manufactured By
PLASTIC CAPACITORS, INC.



POLYSTYRENE films are available as dielectrics and are cataloged in CP70 type cans (Type PD), in bathtub cans (Type PA). Also available are Type PW bathtub capacitors, for close tolerance applications; this type permits the user to adjust the capacitor within ±1% of nominal value, to "tune" the capacitor exactly into his circuit requirements.

PULSE FORMING NETWORKS for Radar modulators are made to suit the special requirements of the industry. A brochure for design criteria and form factors is available, upon request.

TYPE "OT" capacitors are rated from 10 KVDC to 120 KVDC and are in a tubular configuration, in a phenolic case. Axial studs provide the terminations and means of mounting. Except for the lower voltage ranges, they must be operated under oil. Higher voltages upon request.

TYPE LQ CAPACITORS are an economical DC filter, housed in a black Phenolic case with axial leads. Voltage ranges from 1 KV to 12 KV, with oil impregnation (under vacuum) or solid epoxy vacuum impregnation. Very useful in low cost DC power packs with operating temperatures below 65° C.

DISCHARGE CAPACITORS of large capacitance values and high voltages are made to order for your specific application, in a variety of configurations.

SUPER SPECIALS: For many years ,we have supplied power packs and capacitors of such peculiar mechanical or electrical characteristics that no other manufacturer will even attempt to quote on the print. When you are completely lost for a supplier, call us! We can probably supply an item that will do the job or tell you who can make it, if it is not within our capabilities.